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ALUMINUM INVENTORIES OF WEST COAST AIRCRAFT INDUSTRY

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ALUMINUM INVENTORIES OF WEST COAST AIRCRAFT INDUSTRY

PART I

INTRODUCTION

The Senate Small Business Committee has received over the past 6 months a number of complaints on alleged hoarding of aluminum in the aircraft industry along the west coast. These charges have been of grave concern to the committee. Some 14,000 small aluminum fabricators, who as a group use less than 5 percent of domestic production, are facing extinction because of the critically tight supply of aluminum. Even a small, excessive inventory on the part of any aircraft manufacturer could mean the difference between life and death for a substantial number of fabricators. The committee recognizes the overwhelming importance of the aircraft program. On the other hand, the committee does not believe that it should withhold criticism of carelessness in that program, particularly when the carelessness can have such severe repercussions in other segments of the economy.

Shortly before the end of the recent session of Congress, the committee directed the staff to make a thorough investigation of the inventories of the major aircraft producers in the West. On October 29 the committee received a joint request from Senator Spessard L. Holland and Senator George Smathers asking for an investigation of reports of aluminum hoarding.

The measurement of the aluminum inventory on an over-all basis in the aircraft industry must make allowances for certain factors which, if not taken into consideration, may distort the inventory picture to such an extent as to prove it meaningless. These factors are—

(*a*) The quantity and schedule of the end products being produced from the inventory.

(*b*) The stability of the production schedules.

(*c*) The number of design changes required in the end product.

(*d*) The kind, shapes, and sizes of materials required to produce airplanes and the ability of the raw material producers to maintain a balanced schedule of delivery of all items.

(*e*) The ratio of the different kinds, shapes, and sizes of materials to each other in the over-all inventory.

(*f*) The question of minimum mill runs and economical procurement.

(*g*) The supply of spare parts in relation to initial schedules.

(*h*) The problem of substitutions when proper material cannot be obtained.

Any one or combination of these factors can cause a normal inventory to become unbalanced, producing an apparent short or long over-all inventory on paper when in reality the opposite may be true.

(*a*) *The quantity and schedule*

A specific example of the effect of the quantity and schedule is that of a large airplane with a relatively low production rate. The delivery schedule by contracts is as follows:

1953—April	9	1953—September	29
May	21	October	31
June	22	November	33
July	25	December	35
August	27	January	35

Considering the fabrication time plus the inventory time plus the procurement time, it becomes necessary to place purchase orders for materials 21 months in advance of the delivery date of the first airplane. Scheduling must take into consideration the tooling turn-over rates and determine the quantities of units to be put into production in order to operate efficiently. The lot sizes and the months they are to be put into production are—

1952—June	45	1952—November	-----
July	-----	December	50
August	50	1953—January	-----
September	-----	February	62
October	57		

Advancing these dates to allow for inventory, it calls for 95 sets in the third quarter of 1952 and 112 sets in the fourth quarter of 1952. Purchase orders for the material required in April of 1952 must be placed 6 to 9 months in advance of April, in order to assure mill time.

In connection with the lead time involved, North American Aviation, Inc., stated:

> Under present conditions, the reservation for our total aluminum requirements in a given month must be placed from 6 to 9 months ahead of the mill-run month. Detailed orders specifying quantities, sizes, and properties must be placed at least 60 days ahead of the mill-run month. Shipment frequently is made as much as 30 days after the end of a mill-run month, and 60 days minimum must be allowed for shipping, unloading, inspection, and warehousing prior to the date when the material is required in work. This cycle is set forth below in a typical example, using an in-work requirement of August 1 as the key date:

	Date	Months prior to in-work date
Detailed order placed	Mar. 1	5
Ingot placed in work	Mar. 15	4½
Start of mill-run month	May 1	3
Start of shipment, travel, and unloading (30 days)	May 30	2
Start of inspection, warehousing (30 days)	July 1	1

The foregoing is an ideal cycle. In actual practice, this company finds it desirable to order 75 days ahead of the mill-run month, bringing the date up to February 15 and the lead time up to 5½ months. Also, it is found that shipments are frequently made later than the last day of the scheduled mill-run month, which loss must be absorbed out of the time allowed for inspection and warehousing. As can be seen in the tabulation of this cycle, the aluminum producer incurs costs against the order sometime between March 1 and 15, or approximately 5 months before the required in-work date. Approximately 2 to 3 months before the in-work date the cancellation charges are, in effect, up to 100 percent, because the producers are not able to process a cancellation after the mill run starts. Accordingly, a cancellation which we might find necessary on the basis of a Government schedule change reaching us April 1 affecting

August in-work requirements would almost certainly result in a claim for costs incurred unless it is possible for the producer to divert the material to another customer. In other words, even though we request a cancellation 4 months before the in-work date, we would face the possibility of inflating the cost of the product to the Government (through material cancellation charges) in order to avoid a possible surplus under present inventory limitation regulations. Obviously, this would be a ridiculous course to follow if the material were later required for fulfillment of our contract with the Government, defeating the interest of the Government in both economy and material utilization. For the material thus refused by the airframe manufacturer (although paid for up to 100 percent) would probably be scrapped if no other customer could be found for it. It may be added to this brief review of the lead-time situation that cancellation requests frequently are not even answered by the aluminum producers for 30 days. This is not critical of these producers, who also have a serious problem in trying to run down a small item in their mill schedules and arriving at a disposition decision.

(*b*) *The stability of the schedule*

Often the scheduled delivery of the end items produced from the inventory is changed during the period from the placement of purchase orders to issuance of material. In some cases the schedules are retarded due to lack of equipment or major components which are purchased or Government-furnished and other times the schedules are advanced because of the service requirements. Cases where schedules are retarded for 1 month provide a good example. It becomes necessary to reschedule thousands of purchase orders and these orders must be taken out of the allocated quarter and put into the next quarter. Often the mill schedules are closed in the following quarters and would require a reschedule of 4 to 6 months, which obviously cannot be done without a corresponding delay in the receipt of materials and end-product delivery. The only other alternative is to allow the scheduled material to be shipped in accordance with the original schedule and reduce subsequent months' receipts. This, however, will cause apparent long inventories for a period of time.

When schedules are advanced emergency procurement must be made. When emergency procurements are made, the "easy-to-produce" items are shipped but the more difficult ones lag, causing inventory unbalance. Since the inventory reflects only the on-hand materials and not the shortages, this unbalance may make the inventory appear excessive when actually the inventory is short.

(*c*) *The number of changes required in the end product*

Military aircraft programs are subject to frequent and relatively violent adjustments. Particularly is this true in periods when the aircraft being produced are being utilized in combat. Most of today's tactical airplanes are what is known to the trade as experimental airplanes released for production.

The effect of changes on the end product is the same as a reschedule. The adjustments may involve a sudden acceleration or deceleration of production rates. In the former instance the manufacturer scrambles for additional materials. In a deceleration he may be thrown immediately into the position of having more than a 60-day inventory for the new requirements and additional materials en route to support the old rate.

Even without an intentional reduction in rate, there are many instances where scheduled usage of material must be reduced. For example, if Government-furnished items like engines or instruments or radar cannot be supplied by the Government to support the scheduled

airframe assembly rate, then the airframe manufacturer may be forced to reduce his in-work withdrawals from the warehouse in order to keep the fabrication and assembly program in phase. Another common occurrence is the reduction of usage rate because of pending major design changes requested by the Government for incorporation in production at an early date. By their nature, such design changes might affect a given item of material or group of items disproportionately, resulting in an inventory in excess of 60-day requirements for that item or group of items. For example, a major fuselage change may affect the particular sizes and thicknesses of sheet predominately used in the fuselage. The time lag in processing contractual changes frequently serves to accentuate the effect of the changes on inventory-usage ratios. A delay of 60 days in processing an anticipated change, during which the manufacturer has no assurance either way, may cause the manufacturer to end up either short or long if he estimates wrong.

Not all changes that affect the in-work material requirements originate with the Government. Among the factors that may create such changes at the airframe manufacturer's level are subcontracting decisions, changes, or delays; efforts to stabilize shop manpower loading under various production contracts so as to avoid critical manpower peaks and valleys; unpredictable deviations from past experience in the nesting of cut-outs from sheet stock on new design airplanes; unpredictable deviations from past experience in the material required to complete tube lay-outs in new design airplanes; late release of production engineering drawings to the factory caused by unforeseen development problems on new types of aircraft; delays in delivery of production machinery and equipment; delays in delivery of raw material or items of equipment required in the airplane; and unpredictable deviations in the rejection rate on parts for new design airplanes. Many of these factors are of sufficient magnitude to affect the aggregate inventory position, and all could cause "surplus" inventory at any time on individual items.

(*d*) *The kind and sizes of materials required to produce airplanes and the ability of the raw material producers to maintain a balanced schedule*

In a modern airplane over 4,000 different sizes, shapes, and kinds of raw materials are required, of which 2,100 are aluminum.

The following tabulation shows the number of individual sheet-metal parts used in typical models:

Trainer	4,940
Bomber	13,267
Fighter	6,707
Interceptor	7,221

To maintain an inventory in absolute balance by item is practically an impossibility. In aluminum, for example, the average airplane has—

1. 150 kinds and sizes of sheet.
2. 50 kinds and sizes of plate.
3. 396 aluminum castings.
4. 264 aluminum forgings.
5. 780 extrusions and rolled sections.
6. 200 kinds and sizes of bar.
7. 120 kinds and sizes of tube.
8. 200 miscellaneous, such as wire, strip, hinge, etc.

In an operation of this magnitude, it is obvious that the emphasis must be on a system which will assure efficiency, low cost, and prompt delivery of the end product to the customer rather than on a system which will guard against a small surplus over the next 2 months' usage requirements.

If more than one model is being produced, the number of items in inventory increases considerably in all classifications because of the different designs. It would appear that sheet and plate would remain the same, but by experience the sizes, alloys, and tempers vary considerably from model to model. For example, large airplanes require premium-size sheet where small airplanes can be made from standard sizes. In order for the aluminum producers to maintain a balanced production against the schedule would require the set-up and tear-down of limited machine capacity to the extent that a minimum of aluminum production would result. This causes them to overship one month on some items, while shorting others, causing unbalanced inventories at the airplane producers' plants.

(*e*) *The relation of different kinds and sizes of materials to each other in the over-all inventory*

In inventories where hundreds of different kinds and sizes of materials such as aluminum are required, it is quite possible for a relatively few items of large weight to make an inventory appear excessive at specific cut-offs. For example, in one aircraft surveyed, the center wing-spar caps in raw materials weighed over 20,000 pounds per airplane. The high cost of machining these spars dictates the production run quantity which is a minimum of 25 sets. If the inventory cut-off is a few days prior to the issuance into production, it would show 500,000 pounds of aluminum on hand, which would be a large portion of the inventory. Whereas, if the cut-off were taken after issuance, the inventory would appear small. This same problem is encountered in tapered sheet for aircraft.

(*f*) *Minimum mill runs and economical procurement*

Since the inventory shows only what is on hand and is not related to requirement, the minimum mill runs and economical procurement cause an apparent long inventory. To isolate and exclude them from the inventory would require many hours of record keeping which does not appear justifiable, but should be taken into consideration when measuring inventory on an over-all basis.

(*g*) *Spare parts in relation to initial schedule*

Spare-parts schedules of necessity are made after the production material has been procured which has the same effect on the inventory as a schedule revision—inventory unbalance. At the time an airframe contractor begins to order material to cover a major airplane contract, it is necessary that an estimated amount of aluminum materials be procured in order that the spare-parts delivery schedule requirements can be met when they are established at a later date. The procurement agencies cannot reasonably indicate the detailed spares required in sufficient time to order the material in any other fashion.

Due to the Korean war, the procurement agencies have made urgent demands for large quantities of spot spare parts for use in the combat zone. These spares could not be produced in sufficient time to meet the requirements of the Government unless some inventory of general-

use aluminum articles was maintained. This is not a small program.

Special kits supplied to cover aircraft already delivered are frequently demanded, on an urgent basis, by the procurement agencies in order to cope with combat conditions. Materials to cover such kits can be ordered on no other basis but on an estimate predicated on past usage prior to order, and review of open-end contracts against which urgently needed kits will be ordered in the immediate future.

(*h*) *Substitutions when proper material cannot be obtained*

The substitution of one material for another causes apparent long inventories. Many substitutions must be made when critical material deliveries cannot be made in accordance with schedules. For example, one case where forgings could not be obtained in time to meet assembly requirements, aluminum bar had to be substituted involving excessive machining time and added waste as scrap. In such cases the tie-in between the end of the bar substitution and the time when forgings will be obtained must be determined months in advance. When forgings are obtained, the bar substitution is stopped in order to save the added cost and time of machining and will be in inventory to be used for other substitutions, but it is in the inventory at the take-off and causes the over-all inventory to appear excessive.

PART II

CURRENT INDUSTRY INVENTORY POLICIES

Rulon Nagely, purchasing agent for North American, told the committee:

* * * We have taken * * * the following specific steps directly related to control of the inventory usage ratio on aluminum sheet stock:

(*a*) We have reduced the estimate procurement time from the mills on aluminum sheet stock by 1 month, since our experience on this item indicates a more favorable delivery on this item than on the average item of material.

(*b*) We have installed a closer method of scheduling than was previously used.

(*c*) We have established a perpetual audit of our requirements and receivals in order that we may better control the scheduling of receivals.

We feel that it is pertinent to point out that our aggregate inventory of aluminum sheet was well within the 60-day usage limit prescribed in the regulations. As we will show herein, this type of broad control is the only type of control that is practicable and reasonable for application to the airframe manufacturing industry. Further, it will accomplish the desired results without excessive expenditure of effort on the part of the industry and the Government, and will avoid a situation wherein the industry may be forced to choose between jeopardy of its production or the danger of minor surpluses under exessively detailed controls, with the accompanying necessity of constantly analyzing and arguing fine points of interpretation.

It is believed to be of some significance in connection with this problem that the airframe manufacturing industry does not normally operate within a 60-day material inventory. Obviously, it is to the advantage of any manufacturing concern to hold its inventory to a practicable minimum under normal conditions of material availability, because excessive capital tied up in inventory increases capital requirements, imposes many storage and operating problems, and seriously increases the risk of inventory losses. The aircraft industry is no different from others in these fundamental business considerations, and, further, it is the policy of this company not to buy beyond the requirements scheduled under existing contracts.

Mr. Nagely submitted the following table:

Relationship between inventories and usage of productive materials, North American Aviation, Inc.

Year	Annual turnover rate	Equivalent days of usage represented by inventories
	Times	*Days*
1947	3.0	122
1948	4.3	85
1949	3.6	101
1950	5.0	73
1951	7.6	48

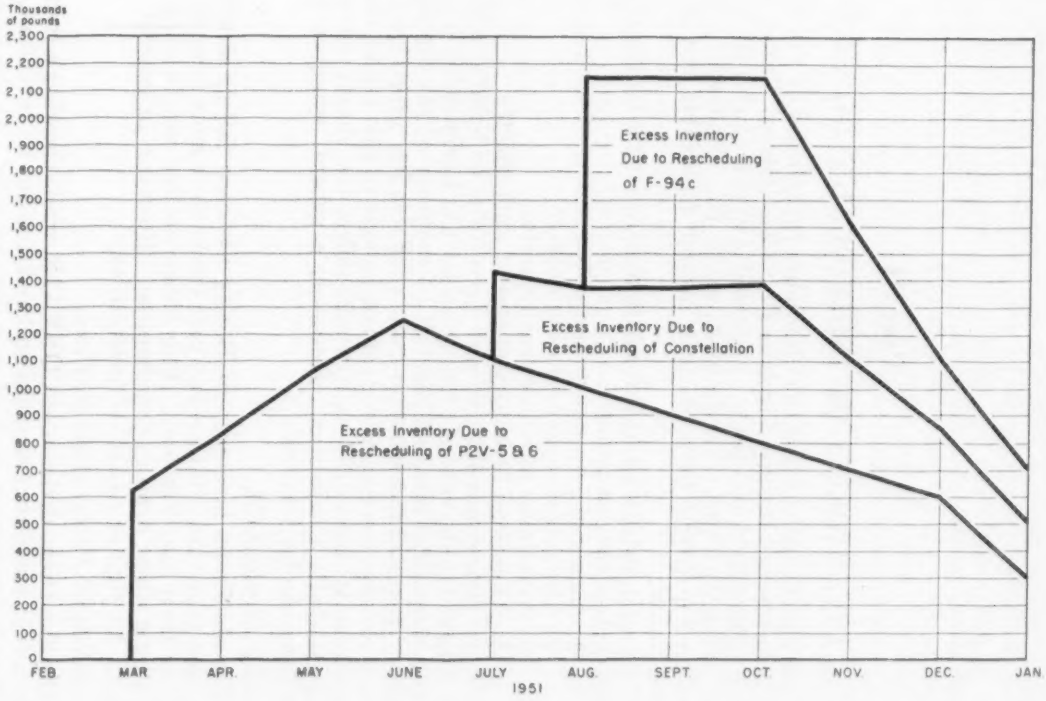
Lockheed, through its director of material, William Shulver, Jr., reported:

In Lockheed's endeavor to exhaust every effort within its control to comply with CMP regulations, certain changes to internal procedures have been made. As as example of such changes, we would like to cite our procurement planning

policy which we are currently applying to aluminum sheet stock inventory. This type of material, for the most part, is on a usage basis rather than individual airplane requirement basis. Purchase orders which are issued for the purpose of replenishing this inventory are planned so as to maintain an average 60-day inventory level. In making these calculations, we have assumed that delivery of aluminum sheet products will be experienced on the last day of the mill month. Under existing regulations, the mill has the privilege of shipment as late as 10 days subsequent to the mill month, which, adding maximum normal transit time, could mean receipt as late as the end of the month following the mill month. Our action is assuming that sheet stock would be delivered at this early date (the end of the mill month) was based upon current receipt experience which indicated the bulk of receipts could be expected at this approximate time. In the acceptance of this premise there were certain hazards which were thoroughly recognized. The most important hazard involved in applying this premise is that purchase orders placed for replenishment of the planned 60-day sheet-stock inventory are based on the assumption that future mill deliveries will be as reasonably on schedule as they have been in previous months. This hazard was accepted in the full view of its potential and was deemed absolutely essential if we were to exhaust every effort within our control to maintain the 60-day inventory level. In accepting this scheduling premise, we have assumed that, in the event this effort to abide by CMP inventory regulations leads to shortages of vitally-required sheet stock, the responsible Government agencies will support our program through the actions available to them, such as releasing critically required materials from Government stockpiles or through the process of issuing directives to suppliers. We cite the above internal procedure policy as an example of the action being taken by this manufacturer to exhaust all efforts within his control to show good faith in the compliance with CMP regulations.

The accompanying chart, prepared by Lockheed, illustrates the cumulative effect changes in airplane production schedules have upon alumium sheet stock inventory. This chart demonstrates that each manufacturing schedule change results in an immediate excess inventory position which continues at an accelerated rate until corrective action can be taken through the rescheduling of purchase commitments.

EXCESS ALUMINUM INVENTORIES OF LOCKHEED AIRCRAFT CORPORATION RESULTING FROM RE-SCHEDULING OF AIRCRAFT PRODUCTION



PART III

INVENTORIES OF INDIVIDUAL COMPANIES

The committee checked the aluminum inventories of the following manufacturers: Boeing Airplane Co.; Consolidated Vultee Aircraft Corp.; Douglas Aircraft Co.; Lockheed Aircraft Corp.; North American Aviation Corp.; Northrop Aircraft, Inc. Statistics were gathered on a quarterly basis to cover, insofar as possible, the 18 months since Korea.

Five main categories of information were sought by the committee from each of the companies:

1. Aluminum inventory at the beginning of each quarter.
2. Aluminum consumed each quarter.
3. Aluminum purchases each quarter.
4. Aluminum inventory at end of each quarter.
5. Time required to exhaust inventories on hand at end of each quarter at the rate of production for the forthcoming quarter.

The committee received the full cooperation of the aircraft companies. Detailed records were made available for inspection. For security reasons, the committee cannot include in this report the statistical material assembled as it would reflect too closely aircraft and guided-missile production. However, a general synopsis for each company can be disclosed.

Boeing Airplane Co.

The aluminum inventory of Boeing has been falling steadily over the past year. At this time last year stocks were more than 42 percent higher than they are now. This sharp decline can be explained in part by a slight drop in consumption. However, in general, it indicates a far tighter control of inventories.

Consolidated Vultee Aircraft Corp.

The San Diego division of CONVAIR, while showing a tremendous increase in aluminum supplies on hand, has cut its inventory, in proportion to production, in half over the past year. At the Fort Worth plant, inventories have almost doubled, but consumption has risen at a far higher rate. There has been a significant drop in the time required to exhaust inventories at this division. Consumption by the guided-missile division is of a relatively small magnitude.

Douglas Aircraft Co.

Although stocks of aluminum have increased substantially at all the Douglas plants (Santa Monica, El Segundo, Long Beach, and Tulsa), the increase has closely paralleled the increase in production. The time required to exhaust inventories on hand has increased slightly, but this reflects (1) a strike at the Long Beach division, (2) heavier production schedules in the immediate future. Inventory control at Douglas is particularly good.

Lockheed Aircraft Corp.

Because of a radical rescheduling of its aircraft production program, Lockheed's inventories were badly out of balance during the third quarter of 1951. For the year of 1950 the entire production inventory turned over at the rate of 4.89 times for the year, a commendable achievement in view of the twelve major models produced. Thus, moving from one of the tightest inventory-control positions in the industry during the first quarter, the manufacturer received two serious cut-backs in its orders, which left it with proportionately high stocks. The committee investigation found that this situation was not the fault of Lockheed but rather the result of the major change in the production program. Lockheed has moved swiftly either to cancel existing orders or delay scheduled deliveries of 2,207,590 pounds of aluminum until the inventory has been worked out.

North American Aviation, Inc.

With consumption up about 20 percent over the first quarter, North American has reduced the time required to exhaust inventories on hand from 72 days at the beginning of the year to about 50 days currently.

Northrop Aircraft, Inc.

Northrop's inventories have increased at a 50 percent greater rate than consumption since Korea. This is partly because of a very rapid expansion in production, but tighter inventory controls seems to be indicated.

PART IV

CONCLUSIONS

The committee found little evidence of excessive inventories in the aircraft companies investigated. There seemed to be a strong drive to maintain inventories at the lowest practical levels. Officials pointed out repeatedly that money tied up in inventories is "dead" money and that the financial situation in the aircraft industry is sufficiently tight to maintain constant pressure against tying money in stocks beyond the most immediate needs.

None of the companies surveyed by the committee reported having any serious difficulty securing primary aluminum for their own needs, although they all had the problem of obtaining materials for the suppliers of components. The easy availability of aluminum to these defense producers makes illogical the occasional claim that the companies were engaged in speculative buying to insure themselves a supply in the future.

With the prospect of aluminum available for civilian production remaining at the same low rate throughout 1953 and part of 1954 as during the first part of 1952, the committee intends to maintain a constant check on the inventory situation to force any excess stocks back into civilian production. At the present time, however, no significant amount of aluminum could safely be diverted to civilian use from the stocks of the aircraft manufacturers investigated.

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